

REMARKS

Despite Applicant previous amendments and remarks submitted with an RCE application, the present Office Action has continued to reject all pending claims. Specifically, claims 1-19, 26, and 27 stand rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Johnson (US 6,525,953) in view of Chakrabarti et al. (US 5,747,135) and Brask (2004/0188387). Applicant respectfully requests reconsideration of this rejection for at least the following reasons.

Independent Claim 1

Independent claim 1 recites:

1. A method of fabricating a semiconductor memory device comprising:
 providing a substrate;
 sequentially forming a first conductive layer, a first type doped semiconductor layer, a first dielectric layer, a second type doped semiconductor layer on the substrate;
 patterning the second type doped semiconductor layer, the first dielectric layer, the first type doped semiconductor layer, and the conductive layer along the first direction, thereby turning the conductive layer into a first conductive line;
 etching the second type doped semiconductor layer, the first dielectric layer, and the first type doped semiconductor layer into a memory cell ***causing particulate silicon residues on the surface of the first conductive line;***
 depositing a second dielectric layer overlying the substrate, ***wherein oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition;***
 planarizing the second dielectric layer to expose the memory cell; and
 forming a second conductive line overlying the second dielectric layer, running generally orthogonal to the first conductive line.

(*Emphasis added*). Claim 1 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

As the Examiner acknowledges in the Office Action, Johnson does not disclose employing oxygen plasma sputtering to clean the substrate before deposition of a layer. Further to this point, Applicant respectfully submits that Johnson fails to disclose, teach or suggest that particulate silicon residues due to etching process are oxidized and removed by oxygen plasma sputtering before deposition of a second dielectric layer.

Chakrabarti et al. do not teach or suggest that the sputtering method is employed to oxidize and remove the particulate silicon residues on the surface of the memory device. In this regard, the memory device taught by Chakrabarti et al. is directed to a magnetic memory disc, which comprises a substrate, a hardening layer and a film made of nonferromagnetic material disposed between the substrate and the hardening layer (col. 1, lines 40-59). There is no indication or suggestion anywhere in Johnson or Chakrabarti regarding if or how oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition. Accordingly, the combination of the Johnson and Chakrabarti would not result in the method of claim 1, which recites “the oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition”.

Moreover, Brask fails to disclose, suggest or teach oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition. In relevant respect, Brask discloses the introduction of an oxidant, such as HNO_3 , H_2O_2 , aqueous solution of HNO_3 , O_3 , O_2 , H_2O_2 , or organic peroxide, however, can help reduce the number of Si nano-crystal in the wet etch bath (para. 10, lines 5-8). There is no indication anywhere in Brask if or how oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues.

Therefore, all cited references, taken singly or in combination, fail to disclose, teach or suggest the step of oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition. As these features are expressly recited in claim 1, for at least this reason, claim 1 patently defines over the cited art. As claims 2-13 and 26 depend from claim 1, these claims are patentable by virtue of their dependency from claim 1.

Independent Claim 14

Independent claim 14 recites:

14. A method of fabricating one time programmable read only memory (OPTROM) device, comprising:
providing a substrate;
sequentially forming a stack of p⁺-doped silicon layer/titanium silicide/titanium nitride/p⁺-doped silicon layer/first dielectric/n-type doped silicon layers on the substrate;
patterning the stack of p⁺-doped silicon layer/titanium silicide/titanium nitride/p⁺-doped silicon layer/first dielectric/n-type doped silicon layers along the first direction, thereby turning the stack of p⁺-doped silicon layer/titanium silicide/titanium nitride layers into a word line;
etching the stack of p⁺-doped silicon layer/first dielectric/n-type doped silicon layers into a memory cell causing particulate silicon residues on the surface of the first conductive line;
depositing a second dielectric layer overlying the substrate, wherein oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition;
planarizing the second dielectric layer to expose the memory cell;
and
forming a stack of n⁺-type doped silicon/ titanium nitride/ titanium silicide /n⁺-type doped silicon/n-type doped silicon layers over the second dielectric layer and patterning the same into a bit line, running generally perpendicular to the word line.

(*Emphasis added*). Claim 14 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

For reasons similar to those set forth above in connection with claim 1, Applicant respectfully submits that Johnson fails to disclose, teach or suggest that particulate silicon residues due to etching process are oxidized and removed by oxygen plasma sputtering before deposition of a second dielectric layer.

Chakrabarti et al. do not teach or suggest that the sputtering method is employed to oxidize and remove the particulate silicon residues on the surface of the memory device. There is no indication anywhere in Johnson and Chakrabarti if or how oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition.

Moreover, Applicant submits that Brask fails to disclose, suggest or teach oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition. Instead, Brask discloses the introduction of an oxidant, such as HNO_3 , H_2O_2 , aqueous solution of HNO_3 , O_3 , O_2 , H_2O_2 , or organic peroxide, however, can help reduce the number of Si nano-crystal in the wet etch bath (para. 10, lines 5-8). Simply stated, there is no indication anywhere in Brask as to if or how oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues.

Therefore, all cited references, taken singly or in combination, fail to disclose, teach or suggest the step of oxygen plasma sputtering is employed to oxidize and remove the particulate silicon residues on the surface of the first conductive line before deposition. For at least this reason, independent claim 14 patentably defines over the cited art. Since claims 15-19 and 27 depend from claim 14, they patentably define over the cited art for at least the same reasons.

As a separate and independent basis for the patentability of certain claims, Applicant submits that the combination of the cited references does not render the claims obvious. In this regard, the Office Action combined Johnson and Chakrabarti to reject the claims on the solely expressed basis that “both [are] from the same field of endeavor ... Therefore, it would have been obvious ... to modify Johnson by employing oxygen plasma sputtering to clean the substrate... as taught by Chakrabarti to contaminants form [sic] the substrate.” (Office Action, p. 3). This rationale is both incomplete and improper in view of the established standards for rejections under 35 U.S.C. § 103.

In this regard, the MPEP section 2141 states:

Office policy has consistently been to follow Graham v. John Deere Co. in the consideration and determination of obviousness under 35 U.S.C. 103. As quoted above, the four factual inquires enunciated therein as a background for determining obviousness are briefly as follows:

- (A) Determining of the scope and contents of the prior art;
- (B) Ascertaining the differences between the prior art and the claims in issue;
- (C) Resolving the level of ordinary skill in the pertinent art; and
- (D) Evaluating evidence of secondary considerations.

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BASIC CONSIDERATIONS WHICH APPLY TO OBVIOUSNESS REJECTIONS

When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to:

- (A) The claimed invention must be considered as a whole;
- (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;
- (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention and
- (D) Reasonable expectation of success is the standard with which obviousness is determined.

Hodosh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

Simply stated, the Office Action has failed to at least (1) ascertain the differences between and prior art and the claims in issue; and (2) resolve the level of ordinary skill in the art. Furthermore, the alleged rationale for combining the two references (i.e., reducing contaminants) embodies clear and improper hindsight rationale. For at least this additional reasons, Applicant submits that the rejections of all claims are improper and should be withdrawn.

Conclusion

For the reasons described above, all claims 1-19 and 26-27 are believed to be in condition for allowance, and the Examiner is respectfully requested to pass those claims to issuance. If the Examiner believes a teleconference will expedite the examination of this application, the Examiner is invited to contact the undersigned attorney at 770-933-9500.

No fee is believed to be due in connection with this submission. If, however, any fee is deemed to be payable, you are hereby authorized to charge any such fee to deposit account 20-0778.

Respectfully submitted ,

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